



# Racial/ethnic disparities in short sleep duration by occupation: The contribution of immigrant status



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## ARTICLE INFO

### Article history:

Received 29 October 2013

Received in revised form

8 July 2014

Accepted 28 July 2014

Available online 30 July 2014

### Keywords:

United States

Sleep

Immigrant

Occupation

Race

Ethnicity

## ABSTRACT

Sleep duration, associated with increased morbidity/mortality, has been shown to vary by race and occupation. Few studies have examined the additional influence of immigrant status. Using a nationally-representative sample of 175,244 US adults from the National Health Interview Survey from 2004 to 2011, we estimated prevalence ratios (PRs) for short sleep duration (<7 h/per day) among US- and non-US born Blacks and Latinos by occupation compared to their White counterparts using adjusted Poisson regression models with robust variance. Non-US born participants' mean age was 46 years, 55% were men, 58% were Latino, and 65% lived in the US  $\geq 15$  years. Short sleep prevalence was highest among US- and non-US born Blacks in all occupations, and the prevalence generally increased with increasing professional/management roles in Blacks and Latinos while it decreased among Whites. Adjusted short sleep was more prevalent in US-born Blacks compared to Whites in professional/management (PR = 1.52 [95% confidence interval (CI): 1.42–1.63]), support services (PR = 1.31 [95% CI: 1.26–1.37]), and laborers (PR = 1.11 [95% CI: 1.06–1.16]). The Black–White comparison was even higher for non-US born Black laborers (PR = 1.50 [95% CI: 1.24–1.80]). Similar for non-US born Latinos, Latinos born in the US had a higher short sleep prevalence in professional/management (PR = 1.14 [95% CI: 1.04–1.24]) and support services (PR = 1.06 [95% CI: 1.01–1.11]), but a lower prevalence among laborers (PR = 0.77 [95% CI: 0.74–0.81]) compared to Whites. Short sleep varied within and between immigrant status for some ethnicities in particular occupations, further illuminating the need for tailored interventions to address sleep disparities among US workers.

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## 1. Introduction

Short sleep duration (<7 h/per day) is associated with an increased risk of weight gain and obesity, hypertension, type 2 diabetes, cardiovascular disease and subsequent mortality (Alvarez and Ayas, 2004; Ayas et al., 2003; Buxton and Marcelli, 2010; Gangwisch et al., 2008, 2007; Gottlieb et al., 2005; Gottlieb et al., 2006; Grandner et al., 2010a; Hammond, 1964; Steptoe et al., 2006; Taheri et al., 2004). Prior studies have shown that sleep duration varies by race/ethnicity in the US (Hale and Do, 2007; Lauderdale et al., 2006), and insufficient sleep duration may be a fundamental contributor to racial/ethnic health disparities. For instance, Africans Americans are the most likely to experience poor sleep quality and extreme sleep duration (too short and too long)

(Adenekan et al., 2013; Durrenre and Lichstein, 2006; Grandner et al., 2010b; Hale and Do, 2007; Jackson et al., 2013a; Patel et al., 2010; Rutter et al., 2011; Zizi et al., 2012). While Latinos appear to generally have a more favorable sleep profile compared to Whites, the findings have been mixed (Grandner et al., 2010b).

Independent of race/ethnicity, short sleep, linked to lower work productivity and occupational injuries, also varies by industry and occupation among US workers (Kuhn and Lozano, 2008; Luckhaupt et al., 2010). In turn, working conditions can directly affect sleep patterns for employees via shift work, long work hours, job strain, and financial hardship (Ota et al., 2005; Pilcher et al., 2000; Ruggiero and Redeker, 2013; Tucker et al., 1998). However, there has been limited investigation of how race/ethnicity status can moderate occupational differences in sleep. In a previous study, we found that the prevalence of short sleep was highest among Blacks in professional/management roles, and lowest among their White counterparts (Jackson et al., 2013b). We concluded that the high prevalence of short sleep among professional Blacks may be

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attributed to limited professional/social networks, greater exposure to discrimination and home stress, lower prioritization of sleep, and stress related to John Henryism, which may negatively impact health when aspirations are not supported by resources (Adenekan et al., 2013; Grandner et al., 2012; James, 1994). Black–White differences in sleep duration by industry and occupation may arise among laborers because Blacks are more likely to be engaged in shift work (especially night shifts) with non-standard work schedules and to work multiple low-wage jobs (Pilcher et al., 2000; Presser, 2003). Blacks are also more likely to have long work hours, report job stress related to discrimination and to work in positions characterized by low control but high levels of job demands (Hughes and Dodge, 1997; Tomfohr et al., 2012).

The degree of exposure to factors that affect sleep likely differ by race/ethnicity, socioeconomic status and immigration in complex ways, and we focus on the moderating role of immigrant status in racial/ethnic sleep disparities by occupational categories because previous studies that may not be generalizable suggest that sleep patterns among immigrants, regardless of race, may differ importantly from individuals born in the US (Ertel et al., 2011; Hurtado et al., 2012; Seicean et al., 2011; Voss and Tuin, 2008). For instance, Caribbean Americans in New York reported fewer sleep complaints than African Americans, but immigrant European Americans reported more sleep complaints than European Americans born in the US (Ertel et al., 2011). Furthermore, Mexican-born immigrants appear to have more favorable sleep than US-born Mexicans (Seicean et al., 2011). A previous study concluded that sleep may contribute to health disparities between Mexican immigrants and U.S.-born Mexican Americans because U.S.-born Mexican Americans have higher rates of smoking and stress levels, which are associated with increased risk of short sleep (Hale and Rivero-Fuentes, 2011).

Many immigrant groups to the US and racial/ethnic minorities are segregated within the labor market into lower-wage and lower-skilled jobs (Chung-Bridges et al., 2008; Ertel et al., 2008; Hurtado et al., 2012; Krieger et al., 2006; Orrenius and Zavodny, 2009), which in turn affects the level of exposure to job-related stressors and hazards. Assimilation and acculturation to US culture (work-related and beyond) also likely influence health beliefs and behaviors that can impact sleep quality and quantity (Lara et al., 2005). However, very few nationally representative studies have investigated the impact of immigrant status on the work-sleep relationship. Therefore, we sought to contribute to the literature by examining differences in short sleep duration by immigrant status and occupational category using a nationally representative sample of US- and non-US-born White, Black and Latino adults participating in the National Health Interview Survey from 2004 to 2011. This study uniquely allows for socioeconomic variation within racial/ethnic groups (i.e. Whites, Blacks, and Latinos) and immigrant status in the US.

The socioecologic model served as our conceptual framework, and has been described in detail elsewhere (Committee on Assuring the Health of the Public in the 21st Century, 2002). In brief, the model is based on the notion that individual behaviors such as sleep are influenced by complex and dynamic interrelations between the person and his or her physical (built and natural), social, institutional, and cultural environments across the lifespan. For instance, sleep disparities by race, socioeconomic status, and immigration may emerge due to factors on multiple levels or dimensions, including: intrapersonal (e.g. genetics and biology; sleep hygiene practices); interpersonal (e.g. workplace and household roles and demands; experiences of discrimination); organizational (e.g. workplace social cohesion; wellness policies); community (e.g. urban residence, traffic noise, fear of crime, commute); and public policies (e.g. noise ordinances; overtime restrictions). The model

also acknowledges the complexity of human situations (e.g. cumulative impact of suboptimal sleep) as behaviors can change over time. Particular occupational conditions that may influence sleep differentially across race/ethnicity and immigrant status include socioeconomic status (e.g. income, education, wealth), psychosocial factors (e.g. job strain, discrimination, organizational culture), and services (healthcare access and utilization; worksite wellness policies) (Ertel et al., 2011; Grandner et al., 2012, 2010b, 2013; Hicken et al., 2013; Lewis et al., 2013; Slopen and Williams, 2014). It is likely that factors such as social class, racism and culture have the potential to influence sleep quantity and quality on multiple levels. We hypothesized that, among racial/ethnic minority groups, immigrants (especially laborers) will report a higher prevalence of short sleep than US-born minorities as well as Whites. Blacks (regardless of immigration status) would have the highest prevalence of short sleep across occupations, followed by US-born Latinos.

## 2. Methods

### 2.1. The National Health Interview Survey

We analyzed National Health Interview Survey (NHIS) data – a series of cross-sectional, nationally representative surveys – based on in-person household interviews among non-institutionalized US civilians using a three-stage stratified cluster probability sampling design. Detailed NHIS procedures have been published elsewhere (“National Center for Health Statistics, Centers for Disease Control and Prevention. National Health Interview Survey. Hyattsville, MD. Available at: <http://www.cdc.gov/nchs/nhis.htm>. Accessed July, 2014,”). Briefly, trained interviewers from the US Census Bureau interviewed a probability sample of households on a continuous weekly basis to collect data on health and other characteristics of each sampled household member. Computer-assisted personal interviewing (CAPI) was used to collect the data. More extensive health-related information was collected from one randomly selected adult and child (if available). Our analysis focused on adults, and the final response rate for sample adults was 67% (range by survey year: 61–72%). The Harvard School of Public Health’s Institutional Review Board approved our study, and informed consent from each study participant was obtained by the NHIS.

### 2.2. Study participants

Our study included non-Latino White, non-Latino Black and Hispanics/Latinos (hereafter, White, Black and Latino) aged  $\geq 18$  years. Study participants (3%) were excluded if they had missing data on sleep duration, employment status, industry and immigrant status, were classified as unemployed or not in the labor force, or had an extreme body-mass index (BMI) (i.e. either  $<15$  or  $>70$  kg/m<sup>2</sup>). BMI restrictions were incorporated to improve data quality by excluding those who reported implausible values. We also excluded those who reported being in the armed forces as NHIS is not designed to provide accurate estimates of military personnel. Our final sample ultimately consisted of 175,244 adults.

### 2.3. Sleep duration

Sleep duration was measured by asking participants the average hours of sleep they usually get in a 24-h period. Trained interviewers reported hours of sleep in whole numbers, and rounded values of 30 min or more up to the nearest hour and otherwise rounded down. We defined short sleep as  $<7$  h of sleep in a 24-h period based on National Sleep Foundation recommendations,

since 7 h has been associated with the lowest morbidity and mortality in previous studies, and because we had a sufficient sample size for stable estimates (Alvarez and Ayas, 2004; Grandner et al., 2010a; “How much sleep do we really need? [www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need](http://www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need),” 2014; Jackson et al., 2013a).

#### 2.4. Immigrant status and citizenship

All participants were asked, “Where were you born?” and were considered US born if they reported being born in a U.S. state or the District of Columbia, or a U.S. territory. Non-US-born were those who reported being born outside the U.S. or U.S. territories. Non-US-born individuals were classified as living in the US for either less than or at least 15 years. Citizenship was also measured by asking participants, “Are you a citizen of the United States?” Participants could reply ‘yes, U.S. citizen’ or ‘no, not U.S. citizen.’ The affirmative value includes: “Yes, born in one of 50 U.S. states or the District of Columbia; Yes, born in Puerto Rico, Guam, American Virgin Islands, or other U.S. territory; Yes, born abroad to American parent(s); and Yes, U.S. citizen by naturalization.”

#### 2.5. Race and ethnicity

Participants self-identified their race and ethnicity. All study participants were asked, “What race or races do you consider yourself to be?” They then selected 1 or more of the following categories: White, Black/African American, Asian, American Indian/Alaskan native or multiple races. Ethnicity data, in terms of being Latino or not, was captured based on national origin or ancestry, which refers to the national or cultural group from which the participant descended. Participants were asked, “Which of those groups best describes your national origin or ancestry?” and the following options were provided: ‘Puerto Rican’, ‘Cuban/Cuban American’, ‘Dominican (Republic)’, ‘Mexican’, ‘Mexican American’, ‘Central or South American’, ‘Other Latin American’, and ‘Other Hispanic/Latino/Spanish’ along with non-Hispanic/Latino ancestry groups such as ‘American’, ‘Other Europeans’, ‘Black’, and ‘Asian or Pacific Islander.’ Participants were not asked to consider a particular number of generations when determining origin. The Latino category consisted of ‘Mexican’ (37% for US-born and 50% for non-US-born), ‘Mexican American’ (25% for US-born and 7% for non-US-born), ‘Puerto Rican’ (10% for US-born and 8% for non-US-born), ‘Cuban/Cuban American’ (4% for US-born and 5% for non-US-born), ‘Dominican (Republic)’ (3% for US-born and 4% for non-US-born), ‘Central or South American’ (17% for US-born and 25% for non-US-born), and ‘Other’ (4% for US-born and 1% for non-US-born).

We focus on differences in short sleep between Whites, Blacks and Latinos. Whites were used as the comparison group because they represent the largest racial group as well as the largest sample size, thereby providing greater statistical stability. Asians were not included because the vast majority (i.e. 72%) of this group was non-US born; therefore, we could not robustly stratify them by immigrant status and occupation. We, however, recently investigated the work-sleep relationship by industry of employment and occupation among Asians in the US (Jackson et al., 2014).

#### 2.6. Industry of employment and occupation

North American Industrial Classification System (NAICS) Codes were meaningfully combined to create the following 8 industry categories: 1) ‘Education Services’, 2) ‘Health Care and Social Assistance’, 3) ‘Retail Trade’, 4) ‘Accommodation and Food Services’ 5) ‘Information’, ‘Finance and Insurance’, and ‘Real Estate and

Rental and Leasing’, 6) ‘Construction’, ‘Manufacturing’, ‘Agriculture, Forestry, Fishing, and Hunting’, ‘Mining’, ‘Utilities’, and ‘Wholesale Trade’, and ‘Transportation and Warehousing,’ 7) ‘Professional, Scientific, and Technical Services’, ‘Management of Companies and Enterprises’, and ‘Administrative and Support and Waste Management and Remediation,’ as well as 8) ‘Other Services (except Public Administration)’, ‘Public Administration,’ and ‘Arts, Entertainment, and Recreation.’

Based on the Standard Occupational Classification System, each participant's occupation was determined among adults who were either working at a paying or non-paying job during the week preceding the survey, who had a job or business but were not at work during the previous week, or who had ever worked. We combined occupation categories into ‘professional/management’, ‘support services’ and ‘laborers’ depending on type of work.

#### 2.7. Covariates

Class of work/occupation was categorized as either: 1) an employee of a private company, business, or individual for wages, salary, or commission; 2) a federal, state, or local government employee; 3) self-employed in own business, professional practice or farm; or 4) or working without pay in a family-owned business or farm, which was based on current, longest held, or most recently held job or work situation. Based on how the data was provided, household income was dichotomized at above and below \$35,000. Poverty status was based on being below the poverty line after the participants’ best estimate of total income of all family members before taxes and from all sources. Educational attainment was categorized as less than high school (no high school diploma), high school (high school or general equivalency diploma), some college, and at least a college-level education or greater.

Height and weight data were self-reported, and were used to calculate body mass index (BMI) by dividing measured weight in kilograms by height in meters squared. Each participant's BMI was classified for obesity status based on standard WHO criteria, such that obesity consisted of a BMI  $\geq 30$  kg/m<sup>2</sup>, overweight was 25.0–29.9 kg/m<sup>2</sup>, normal weight was considered 18.5–24.9 kg/m<sup>2</sup>, and underweight reflected a BMI  $< 18.5$  kg/m<sup>2</sup>. Marital status was classified as never married, married/living with partner, or divorced/separated/widowed. Smoking status and lifetime alcohol consumption were classified as ‘never,’ ‘current,’ or ‘former.’ Leisure-time physical activity levels were labeled as ‘none,’ ‘low,’ or ‘high.’ Participants reporting ‘never’ or ‘unable to do this type activity’ were categorized as ‘none,’ and individuals engaging in at least some level of activity and providing a specific number of activity bouts were dichotomized at the midpoint of the reported bouts and labeled as ‘low’ or ‘high.’ For medical conditions, adults reported if they had ever been told by a doctor or other health professional that they had “hypertension, also called high blood pressure,” “diabetes or sugar diabetes,” or “cancer.” They were also separately asked if they were diagnosed with “coronary heart disease” or “any kind of heart condition or disease other than coronary heart disease, angina pectoris, or a myocardial infarction,” which were all combined as heart disease. Furthermore, self-reported general health status was classified as excellent/very good, good, or fair/poor. Residential regions of the country were categorized as the South, Midwest, Northeast, and West.

#### 2.8. Statistical analysis

Eight survey years (2004–2011) of NHIS data were merged by the Integrated Health Interview Series (“Minnesota Population Center and State Health Access Data Assistance Center, Integrated Health Interview Series: Version 3.0. Minneapolis: University of

Minnesota," 2010). Sampling weights were employed in all analyses to account for non-response, the unequal probabilities of selection to participate in the study based on the study design, and oversampling of certain subgroups (i.e. Blacks, Asians, adults 65+ years of age). Taylor series linearization was used to calculate standard errors for variance estimation (Wolters, 1990), and Rao–Scott Second-order corrected Pearson statistics were used to take survey weights into account for contingency table chi-square tests (Rao and Scott, 1992).

Continuous variables were presented as means  $\pm$  standard errors (SE), and categorical variables as absolute values with percentages. We age-standardized the prevalence of short sleep duration using the 2000 US Census as the standard, and tested for significant differences using Rao–Scott second-order corrected Pearson statistics. We used Poisson regression models with a robust variance estimator to directly estimate prevalence ratios with corresponding 95% confidence intervals for short sleep duration comparisons among US-born and non-US-born Blacks and Latinos compared to their White counterparts by occupation, separately (Barros and Hirakata, 2003). We adjusted first for age in 3 categories (18–49, 50–64, 65+ years), and then for demographic factors such as sex (for models with men and women combined), marital status, and educational attainment, followed by health behaviors including smoking status, alcohol consumption, and leisure-time physical activity, and further adjusted for self-reported health status, hypertension, diabetes, heart disease, cancer and 4 standard BMI categories. We also adjusted, in the same model, for poverty status, household income above or below \$35,000, and classes of occupation. In subsidiary analyses, we investigated if our findings differed among non-US-born participants living in the US for less than or at least 15 years as well as by U.S. citizenship. STATA statistical software version 12 (STATA Corporation, College Station, Texas, USA, 2007) were used for all analyses.

### 3. Results

#### 3.1. Study population

Our study consisted of 175,244 (116,150 White; 27,730 Black; and 31,364 Latino) employed participants, and 59,214 experienced usual short sleep durations (Table 1). Among the 52,098 individuals born in the US, mean age was  $48 \pm 0.09$  years, 49% were women, 54% were married, 15% were Black, 13% Latino, and 23% had at least a college education. Sixteen percent of these participants worked for the government and the highest percentage (43%) worked in a 'support service' occupation. In terms of health behaviors, 52% were never smokers, 16% reported never consuming alcohol and 36% never or were unable to engage in physical activity. The 7116 participants who were not born in the US, compared to those born in

the US, were younger with a mean age of  $46 \pm 0.21$  years, more likely to be married, to never smoke cigarettes or consume alcohol, to never or be unable to engage in leisure-time physical activity, but were less likely to be obese. While the percentage of Blacks (15%) was the same by immigrant status, Latinos represented the largest group of immigrants at 58%. Eleven percent of participants worked for the government and the greatest percentage (51%) were considered laborers.

While US-born Blacks had the highest prevalence of obesity, hypertension and diabetes, the prevalence of these factors were generally lower than (or comparable to) Whites regardless of immigrant status among non-US-born Blacks who were also least likely to report smoking and alcohol consumption. Compared to US-born Blacks, immigrant Blacks were more likely to be married, to have a college education, to have a household income above \$35,000, and to have excellent or very good self-reported health. Sixty-five percent of non-US-born Latinos were classified as laborers and were the least likely to engage in leisure-time physical activity. US-born Blacks were more likely to live in poverty than non-US-born Blacks while US-born Latinos were less likely to live in poverty than non-US-born Latinos. Demographic, health behaviors and clinical characteristics between US-born and non-US-born Whites were mostly similar.

#### 3.2. Short sleep prevalence by occupation among Whites, Blacks and Latinos

Fig. 1 illustrates age-adjusted prevalence of short sleep duration by occupational category, race and sex, stratified according to US-born vs. non-US-born workers. Short sleep prevalence generally increased with increasing professional roles in Blacks and Latinos (except non-US-born women) while it generally decreased in Whites (especially US-born women). Short sleep prevalence was lower among US-born Blacks who were laborers compared to their non-US-born counterparts. Moreover, short sleep prevalence was generally higher among US-born and non-US-born Blacks compared to other racial/ethnic groups with the exception of US-born White women who were laborers. Black and White US-born women considered laborers had a similar prevalence of short sleep (35.9 vs. 34.9%) (Table 2).

#### 4. Differences in short sleep duration by immigrant status among Blacks compared to Whites

Table 2 shows adjusted prevalence ratios of short sleep duration for Blacks compared to Whites by occupational category among employed US born and non-US-born participants. Non-US born participant's mean age was 46 years, 55% were men, 58% were Latino, and 65% lived in the US  $\geq 15$  years. Short sleep prevalence

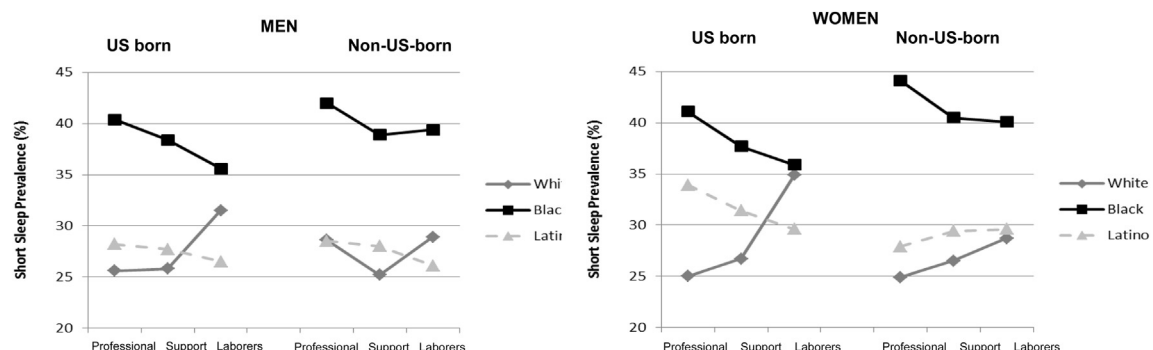


Fig. 1. Age-adjusted prevalence of short sleep duration by occupational category, race and sex among employed US-born and Non-US born participants.

**Table 1**

Sociodemographic, health behavior, and clinical characteristics among 59,214 employed US born and non-US born NHIS participants with short sleep duration by race/ethnicity, 2004–2011.

	US born				Non-US born			
	Short sleep (<7 h)				Short sleep (<7 h)			
	White	Black	Latino	All	White	Black	Latino	All
<b>Sample size, N (%)</b>	33,012 (72)	10,364 (15)	8722 (13)	52,098 (100)	1380 (27)	1071 (15)	4665 (58)	7116 (100)
<b>Age, years ± SE</b>	49.0 ± 0.11	46.1 ± 0.19	43.7 ± 0.20	47.9 ± 0.09	49.9 ± 0.46	44.6 ± 0.49*	44.9 ± 0.26*	46.2 ± 0.21*
<b>Age group, (%)</b>								
18–49	54	61	70	57	52	67	68	63*
50–64	31	28	22	29	31	25	23	26*
≥65	15	11	8	14	17	8	9	11*
<b>Women</b>	48	54	46	49	48	48	43	45*
<b>Educational attainment</b>								
<High school	32	31	29	31	23*	25*	25*	24*
High school graduate	9	12	28	12	8	9	41*	28*
Some college	34	38	29	34	27*	36	20*	25*
≥ College	25	18	14	23	42*	30*	14*	23
<b>Marital status</b>								
Married	57	37	54	54	64*	52*	59*	59*
Divorced/separated/widowed	23	26	20	23	21	21*	20	20*
Never married	20	37	26	23	15*	27*	21*	21*
<b>US citizen</b>	99	95	72	95	72*	60*	47*	56*
<b>Years in US</b>								
<15 years	—	—	—	—	26	43	37	35
≥15 years	—	—	—	—	74	57	63	65
<b>Income (≤\$35,000)</b>	32	47	43	36	31	37*	49*	43*
<b>Living in poverty</b>	9	21	19	12	9	16*	23*	18*
<b>Industry</b>								
Manufacturing/construction	33	26	34	32	28*	20*	41*	35*
Retail	12	9	11	11	10	10	9	10*
Finances/information	9	8	7	8	10	8	4*	6*
Profess/admin/man	9	9	10	9	11	8	11	10
Education	8	9	7	8	10	7	5*	7*
Health care	12	19	11	13	12	29*	8*	13
Accommodation and food	6	6	9	7	7	6	12*	9*
Public administration, arts	11	14	11	12	12	12	10	10*
<b>Occupation</b>								
Professional/management	19	13	12	18	26*	14	8*	14*
Support services	44	47	37	43	43	54*	27*	35*
Laborers	37	40	51	39	31*	32*	65*	51*
<b>Class of worker</b>								
Private wage	76	74	80	76	75	80*	84*	81*
Government	15	22	14	16	13	14*	8*	11*
Self employed	9	4	6	8	12*	6	8	8
<b>Health behaviors</b>								
Smoking status								
Never	47	63	65	52	55*	83*	70*	68*
Current	25	15	17	22	26	8*	16	17*
Former	28	22	18	26	19*	9*	14*	15*
Alcohol consumption								
Never	13	25	23	16	21*	36*	29*	28*
Current	70	59	63	68	69	53*	56*	59*
Former	17	16	14	16	10*	11*	15	13*
Leisure-time physical activity								
Never/unable	33	41	43	36	36	40	51*	45*
Low	34	32	31	33	32	32	29	30*
High	33	27	26	31	32	28	20*	25*
<b>Usual hours of sleep per day</b>	5.64 ± 0.01	5.54 ± 0.01	5.64 ± 0.01	5.62 ± 0.01	5.66 ± 0.02	5.55 ± 0.03	5.66 ± 0.01	5.64 ± 0.01
<b>Clinical characteristics</b>								
Mean BMI, men	28.5 ± 0.05	28.7 ± 0.11	28.9 ± 0.12	28.6 ± 0.05	27.4 ± 0.19*	26.7 ± 0.24*	28.2 ± 0.14*	27.8 ± 0.10*
Mean BMI, women	27.8 ± 0.07	30.6 ± 0.12	29.1 ± 0.14	28.4 ± 0.06	26.2 ± 0.23*	28.1 ± 0.40*	28.3 ± 0.16*	27.7 ± 0.13*
Overweight/obese	67	75	74	69	61*	67*	72	68
Obese	31	41	36	33	21*	25*	31*	27*
Hypertension (yes)	31	37	24	31	27*	27*	24	26*
Diabetes (yes)	8	12	10	9	8	9	10	10
Cancer (yes)	9	4	3	8	8	2*	3	4*
<b>Health status</b>								
Excellent/very good	58	49	52	56	60	64*	48*	54*
Good	27	30	21	28	27	25*	33	30*
Fair/poor	15	21	17	16	13	11*	19	16
<b>Region of country</b>								
Northeast	20	16	17	19	29*	41*	20*	26*
Midwest	29	19	9	25	18*	11*	9	12*
South	34	57	36	38	28*	41*	36	34*
West	17	8	38	18	25*	7	35	28*

Weighted estimates; n (%) or mean ± SE; SE = standard error; NHIS = National Health Interview Survey; overweight/obese defined by body mass index ≥25 kg/m<sup>2</sup>; obesity defined by body mass index ≥30 kg/m<sup>2</sup>; \*p < 0.05 (comparing US born to Non-US born participants).



**Table 2**  
Age-adjusted prevalence of short sleep duration by occupational category, race and sex among employed US-born and Non-US born participants, National Health Interview Survey, 2004–2011.

	US born				Non-US born			
	White	Black	Latino	Total	White	Black	Latino	Total
<i>Men</i>								
Professional/management	25.6 (24.7–26.6)	40.4 (36.7–44.2)	28.2 (25.1–31.3)	30.5 (27.0–34.1)	28.6 (24.7–32.5)	42.0 (31.6–52.3)	28.5 (25.7–31.4)	26.4 (25.5–27.3)
Support services	25.8 (24.9–26.8)	38.4 (35.6–41.2)	27.7 (25.2–30.3)	29.3 (25.7–33.0)	25.2 (20.9–29.4)	38.9 (31.4–46.3)	28.0 (25.5–30.6)	27.1 (26.2–27.9)
Laborers	31.5 (30.7–32.2)	35.6 (33.9–37.2)	26.5 (25.1–27.9)	31.7 (28.7–34.7)	28.9 (25.2–32.7)	39.4 (34.1–44.8)	26.1 (24.8–27.4)	32.0 (31.3–32.7)
<i>Women</i>								
Professional/management	25.0 (23.9–26.1)	41.1 (37.5–44.7)	33.9 (29.6–38.1)	27.3 (22.7–32.0)	24.9 (20.0–30.0)	44.1 (30.6–57.6)	27.9 (24.0–31.8)	26.5 (25.5–27.6)
Support services	26.7 (26.1–27.3)	37.7 (36.2–39.1)	31.4 (29.8–33.0)	30.2 (28.0–32.4)	26.5 (23.8–29.1)	40.5 (36.3–44.6)	29.4 (27.8–31.0)	28.1 (27.5–28.6)
Laborers	34.9 (33.6–36.1)	35.9 (34.1–37.7)	29.6 (27.7–31.5)	31.7 (27.0–36.3)	28.7 (23.6–33.7)	40.1 (30.3–50.0)	29.6 (27.7–31.5)	35.1 (34.0–36.2)

Standard population: 2000 US census; prevalence (95% confidence interval).

was highest among US- and non-US born Blacks in all occupations, and the prevalence generally increased with increasing professional/management roles in Blacks and Latinos while it decreased in Whites. Age-adjusted short sleep was more prevalent in US-born Blacks compared to Whites in professional/management (PR = 1.52 [95% confidence interval (CI): 1.42–1.63]), support services (PR = 1.31 [95% CI: 1.26–1.37]), and laborers (PR = 1.11 [95% CI: 1.06–1.16]) (see [Table 3](#)). These overall patterns were consistent for men and women and the associations were not substantively changed in the fully adjusted models. The Black–White comparison for the US-born participants was similar to that of foreign-born Blacks, except that the Black–White disparity for laborers was relatively small. Black–White comparison was even higher for non-US born Black laborers (PR = 1.50 [95% CI: 1.24–1.80]).

### 5. Differences in short sleep duration by immigrant status among Latinos compared to Whites

Similar to non-US born Latinos, Latinos born in the US had a higher short sleep prevalence in professional/management (PR = 1.14 [95% CI: 1.04–1.24]) and support services (PR = 1.06 [95% CI: 1.01–1.11]), but a lower prevalence among laborers (PR = 0.77 [95% CI: 0.74–0.81]) compared to Whites (see [Table 4](#)). For US-born Latino women considered laborers, the prevalence appeared lower (PR = 0.81 [95% CI: 0.74–0.87]) than US-born White women also considered laborers while not significantly different for non-US-

born Latino women (PR = 1.10 [95% CI: 0.87–1.38]) compared to their White counterparts. Similar to the pattern observed in Blacks, the ethnic gap is not substantially affected by adjustment for covariates, and the patterns are similar for Latino men and women, and there is a distinctive pattern for laborers. While limited sample size precluded us from stratifying all of our results by subgroups, we provided Latino subgroup comparisons of short sleep prevalence, and found that short sleep was highest among Puerto Ricans and lowest among Mexicans regardless of immigrant status (see [Supplemental Table 1](#)). In subsidiary analyses, we did not observe substantial differences in short sleep between non-US-born participants living in the US for less than or at least 15 years (see [Supplemental Table 2](#)). Latinos who were U.S. citizens in both support services (32.3 vs. 20.7) and positions considered laborers (31.0 vs. 24.5) had a significantly higher prevalence of short sleep duration than Latinos who were not US citizens (see [Supplemental Table 3](#)).

### 6. Discussion

In this nationally representative sample of the US, we found that Black immigrant workers had a higher prevalence of short sleep than US-born Black workers, for whom prevalence of short sleep was higher than other US-born groups. We extend beyond previous studies by finding that, while short sleep duration among Latinos appeared generally similar to Whites, all Blacks and Latinos (except

**Table 3**  
Prevalence ratios of short sleep duration for Blacks compared to Whites by occupational category among employed US born and Non-US born participants, National Health Interview Survey, 2004–2011.

	US born				Non-US born			
	White	Black	Age adjusted	Fully adjusted	White	Black	Age adjusted	Fully adjusted
<i>Men</i>								
Professional/management	3803	558	1.50 (1.38–1.63)	1.50 (1.36–1.66)	222	94	1.42 (1.13–1.77)	1.49 (1.16–1.93)
Support services	3967	1201	1.42 (1.33–1.52)	1.39 (1.29–1.51)	170	173	1.75 (1.42–2.15)	1.70 (1.31–2.20)
Laborers	8031	2423	1.14 (1.09–1.19)	1.15 (1.09–1.22)	268	236	1.39 (1.16–1.68)	1.36 (1.09–1.69)
<i>Women</i>								
Professional/management	2499	694	1.65 (1.52–1.79)	1.56 (1.41–1.73)	123	52	1.64 (1.20–2.26)	1.53 (1.03–2.25)
Support services	10,737	3840	1.40 (1.35–1.45)	1.29 (1.23–1.35)	442	422	1.57 (1.37–1.80)	1.47 (1.22–1.76)
Laborers	3848	1606	1.07 (1.01–1.14)	1.02 (0.95–1.11)	150	89	1.65 (1.23–2.21)	1.91 (1.40–2.61)
<i>Both</i>								
Professional/management	6302	1252	1.56 (1.47–1.65)	1.52 (1.42–1.63)	345	146	1.49 (1.24–1.79)	1.54 (1.24–1.92)
Support services	14,704	5041	1.41 (1.36–1.45)	1.31 (1.26–1.37)	612	595	1.63 (1.45–1.83)	1.56 (1.34–1.80)
Laborers	11,879	4029	1.12 (1.08–1.16)	1.11 (1.06–1.16)	418	325	1.47 (1.26–1.72)	1.50 (1.24–1.80)

Fully adjusted model: age categories, sex (for model with men and women combined), marital status, educational attainment, living in poverty, smoking status, alcohol consumption, physical activity, health status, body mass index, hypertension, diabetes, heart disease, cancer, class of occupation, household income.

**Table 4**

Prevalence ratios of short sleep duration for Latinos compared to Whites by occupational category among employed US born and Non-US born participants, National Health Interview Survey, 2004–2011.

	US born				Non-US born			
	White	Latino	Age adjusted	Fully adjusted	White	Latino	Age adjusted	Fully adjusted
<i>Men</i>								
Professional/management	3803	456	1.12 (1.02–1.25)	1.06 (0.94–1.19)	222	176	0.93 (0.76–1.14)	0.85 (0.66–1.10)
Support services	3967	848	1.04 (0.96–1.13)	1.03 (0.93–1.13)	170	365	1.09 (0.90–1.33)	1.10 (0.86–1.41)
Laborers	8031	2704	0.76 (0.72–0.79)	0.76 (0.72–0.81)	268	1728	0.80 (0.70–0.92)	0.77 (0.65–0.91)
<i>Women</i>								
Professional/management	2499	442	1.27 (1.14–1.41)	1.26 (1.11–1.43)	123	162	1.16 (0.91–1.49)	1.15 (0.86–1.54)
Support services	10,737	2589	1.10 (1.05–1.16)	1.08 (1.02–1.14)	442	1007	1.06 (0.94–1.20)	1.03 (0.87–1.21)
Laborers	3848	1647	0.78 (0.73–0.83)	0.81 (0.74–0.87)	150	1203	1.03 (0.86–1.24)	1.10 (0.87–1.38)
<i>Both</i>								
Professional/management	6302	898	1.18 (1.09–1.27)	1.14 (1.04–1.24)	345	338	1.00 (0.86–1.18)	0.95 (0.78–1.15)
Support services	14,704	3437	1.08 (1.04–1.13)	1.06 (1.01–1.11)	612	1372	1.07 (0.97–1.19)	1.06 (0.92–1.21)
Laborers	11,879	4351	0.77 (0.74–0.80)	0.77 (0.74–0.81)	418	2931	0.87 (0.78–0.97)	0.85 (0.74–0.98)

Fully adjusted model: age categories, sex (for model with men and women combined), marital status, educational attainment, living in poverty, smoking status, alcohol consumption, physical activity, health status, body mass index, hypertension, diabetes, heart disease, cancer, class of occupation, household income.

foreign-born Latino women) had a prevalence of short sleep that increased with increasing professional responsibility while Whites generally had the opposite relationship – decreasing short sleep prevalence with increasing professional roles. Of note, Black and White US-born women working as laborers had a similar prevalence of short sleep. Immigrant status has been shown to be independently associated with a higher likelihood of short sleep (Voss and Tuin, 2008), and our nationally representative study demonstrates that immigrant status accentuates the racial/ethnic disparities in sleep patterns. Data for Black immigrants are exceptionally sparse (especially nationally representative), but the available data (Ertel et al., 2011; Hurtado et al., 2012) and the key finding from this study suggests that this group has a prevalence of short sleep that is even higher than US-born Blacks. Although Black immigrants appear to be selected in terms of good health (the healthy migrant effect), there are indications of negative health assimilation for Black immigrants from the Caribbean (Hamilton and Hummer, 2011; Williams et al., 2007), which may include sleep.

The available information on the habitual sleep duration of Latinos is mixed, suggesting that its determinant factors are complex. Although the high prevalence of obesity, diabetes, and urban residence among Latinos may suggest that this group is at an increased risk for suboptimal sleep (Daviglius et al., 2012; Hubert et al., 2005; Pabon-Nau et al., 2010), previous research has shown that Mexican Americans report comparable or longer sleep duration than Whites (Grandner et al., 2010b). For instance, data from the BRFSS suggest that Latinos in many states are less likely to report insufficient sleep than Whites (Grandner et al., 2010b). Another study with a non-representative sample found that Latinos (and Blacks) had poorer sleep quality than Whites (Patel et al., 2010). These observations may be contradictory due to differences in participant sampling and sleep duration habits within the various Black and Latino communities in the US. Moreover, our findings may differ from previous studies due to heterogeneity within both the Black and Latino category across studies, cultural bias when interpreting sleep, and differences in statistical modeling strategies. Differences in measurements of sleep as well as outcomes between studies may lead to varying results as some studies captured sleep quality while others (like ours) collected data on sleep duration, which is independently associated with health outcomes.

There are several potential explanations for the similar findings among Latinos and Whites by immigrant status. For some Latino heritages, traditional sleep habits such as ‘siestas’, may still be

practiced; thus increasing the quantity of total sleep (Loredo et al., 2010). Heterogeneity in sleep patterns of distinct Latino ethnic groups may also confound the observed associations (Redline et al., 2014). Similar to the “healthy worker” effect, Latino laborers may also represent a highly select group of particularly healthy and young individuals with minimal sleep disturbances. Furthermore, we could not account for acculturation that may influence factors (e.g. stress levels) that have been shown to influence sleep (Hale and Rivero-Fuentes, 2011).

Further research is warranted to understand the influence of immigrant status on sleep across racial/ethnic groups in the US as well as its influence on work-related characteristics, which might be driving the observed disparities (Kuhn and Lozano, 2008; Ota et al., 2005; Pilcher et al., 2000; Ruggiero and Redeker, 2013; Tucker et al., 1998). While the reasons for our findings remain speculative (for example, foreign-born Blacks may be working longer hours in order to send remittances back home), the findings point to the importance of developing tailored interventions for specific occupational groups rather than developing a one-size-fits-all strategy. Assimilation and/or acculturation – the stress associated with supporting family members in their native countries (through remittances), racial discrimination in the workplace (especially in professional environments) (Bhattacharya and Schoppelrey, 2004; Liang and Fassinger, 2008; Osajima, 2005) – and other unique factors that contribute to immigrant/native-born disparities needs to be investigated. It would also be useful to investigate cultural factors such as the interpretation of sleep measures, and of family structure and social gatherings that may be unique in these populations. Future research should also explore the potential for psychosocial stressors to account for the observed patterns as one of our major findings is that a broad range of demographic, SES, health behavior and health status factors did not account for the observed racial differences. A recent study found that US-born Latinos report markedly higher levels of stress than their foreign-born peers (Slopen and Williams, 2014). Although we did not find short sleep duration to considerably differ between Non-US born participants living in the US for either less than or at least 15 years, length of stay is considered an important indicator of acculturation and prior studies about various health outcomes have found it to be a contributor and should, therefore, be studied in greater detail (Lara et al., 2005). U.S. citizenship and other markers of acculturation (e.g. language spoken) should also be studied more closely as it influences one's access to resources that may impact sleep health (Lara et al., 2005).

Limitations of our study include the cross-sectional study design, and that all data are self-reported. Data from actigraphy and polysomnography measurements, for instance, provide more objective sleep duration information (Lauderdale et al., 2008), but were unavailable in our study. One study evaluating agreement between sleep-reports and objective measures of usual sleep among Blacks and Whites found a moderate correlation ( $r = 0.45$ ) that was systematically biased by various demographic, health and sleep characteristics (e.g. sleep apnea) (Lauderdale et al., 2008). The validation study did not investigate differences by immigrant status and did not include Latinos, which suggests an important area for future research. Furthermore, we could not account for work-to-family spillover and number of children in the household, which likely influence sleep and differs by race. Employment status was based on participants being employed during the week prior to the interview, and is likely to be less stable for lower-SES, minority and some immigrant groups (Muntaner et al., 2004). Unfortunately, we did not have data on shift work, which has been shown to increase risk of morbidity/mortality and to be more prevalent among racial/ethnic minorities (especially Blacks) (Ertel et al., 2011; Ohayon et al., 2010; Pilcher et al., 2000). Lastly, we did not have access to data on medication use that may affect sleep, and self-reported diagnosis of medical conditions by a medical professional likely missed participants with undiagnosed or preclinical conditions, especially among racial/ethnic minority and disadvantaged, immigrant populations.

Nonetheless, our study has important strengths that contribute to the literature and extend beyond previous findings. Our data were based on an overall large sample size with sufficient numbers of both US-born and immigrant Whites, Blacks as well as Latinos. We were also able to stratify the data by multiple factors (i.e. race/ethnicity, industry, immigrant status) while maintaining stable, robust estimates. The factors presented in the aforementioned socioecological model likely differ by race/ethnicity, socioeconomic status and immigration in complex ways, and (unlike previous studies) this study had a sample size large enough to allow for the added complexity and illumination of socially-patterned short sleep duration by investigating within-group socioeconomic or occupational variability among Whites, Blacks and Latinos. Furthermore, we had access to 8 successive years of sleep data, enhancing our power to investigate sleep disparities. Importantly, these data are also nationally representative, and represent a recent time period. Prevalence ratios, rather than odds ratios, were also directly estimated, which makes it easier to interpret results.

In conclusion, differences in short sleep duration varied importantly between employed US- and non-US-born individuals and by occupation. Further investigation of sleep characteristics among immigrants may provide useful insights, and the differences found in this nationally representative study further reflect the need to identify sociocultural and behavioral factors that may influence the complex work-sleep relationship in hopes of effectively addressing the identified sleep disparities to protect and improve health as well as productivity among workers in the US.

## Acknowledgments

The Transdisciplinary Research on Energetics and Cancer (TREC) Center grant (1U54CA155626-01) supported the work of Drs. Hu, Redline and Jackson. Our funders were not involved in the data collection, data analysis, manuscript writing nor publication. This work was presented as a poster presentation at the 141st American Public Health Association Annual Meeting.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2014.07.059>.

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